

WHAT IS CLAIMED IS:

1. An electron-emitting device comprising:
  - (A) an extraction electrode and a negative electrode formed in opposition to each other with a gap between said extraction electrode and said negative electrode on an electrically insulating substrate;
  - (B) a first layer formed on said negative electrode and having an oxide of Ti, an oxide of Zr, or an oxide of Nb on a surface thereof; and
  - 10 (C) a fibrous carbon grown through a catalyst particle disposed on a side wall surface of said first layer on the extraction electrode side.
2. The electron-emitting device according to  
15 Claim 1, wherein only the side wall surface of said first layer on the extraction electrode side is exposed and the other surfaces thereof are covered with a material on which a fibrous carbon does not grow as compared with said first layer.
- 20 3. The electron-emitting device according to  
Claim 2, wherein said material on which a fibrous carbon does not grow as compared with said first layer, is at least either one of Ta, Cr, Au, Ag, Pt, and  
25 materials of the same kind as a material making said catalyst particle.

4. The electron-emitting device according to  
Claim 1, wherein said fibrous carbon consists of a  
graphite nanofiber, a carbon nanotube, an amorphous  
carbon, or a mixture thereof.

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5. The electron-emitting device according to  
Claim 1, wherein said fibrous carbon comprises a  
graphen.

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6. The electron-emitting device according to  
Claim 1, wherein said fibrous carbon comprises a  
plurality of graphens.

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7. The electron-emitting device according to  
Claim 6, wherein said plurality of graphens are layered  
in an axis direction of said fibrous carbon.

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8. The electron-emitting device according to  
Claim 1, wherein said catalyst particle consists of Pd,  
Ni, Fe, Co, or an alloy thereof.

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9. The electron-emitting device according to  
Claim 1, wherein an electron emission position from  
said fibrous carbon is more distant from a surface of  
said substrate than a position of a surface of said  
extraction electrode.

10. The electron-emitting device according to  
Claim 1, wherein said extraction electrode and negative  
electrode are formed on a surface of substantially  
planar shape of said substrate and a thickness of said  
5 negative electrode is larger than a thickness of the  
extraction electrode.

11. The electron-emitting device according to  
Claim 1, wherein said substrate is thicker in a region  
10 where said negative electrode is formed than in a  
region where said extraction electrode is formed.

12. The electron-emitting device according to  
Claim 1, wherein said conductive layer is formed from  
15 on said negative electrode to inside of the gap between  
said extraction electrode and negative electrode on a  
surface of said substrate.

13. An electron source wherein a plurality of  
20 electron-emitting devices as set forth in either one of  
Claims 1 to 12 are arrayed.

14. The electron source according to Claim 13,  
wherein said plurality of electron-emitting devices are  
25 electrically connected to a matrix wiring pattern.

15. An image-forming apparatus wherein an image-

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forming member for forming an image by collision of emitted electrons is disposed at a position where the image-forming member faces the electron source as set forth in Claim 13.

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16. An electron-emitting device comprising:

(A) a first electrode and a second electrode placed in opposition to each other with a gap between said first and second electrodes on a surface of a  
10 substrate; and

(B) a plurality of fibers electrically connected to said first electrode and comprising carbon as a main component,

15 wherein said fibers are placed on a surface of said first electrode facing said second electrode.

17. The electron-emitting device according to Claim 16, wherein each of the fibers comprising the carbon as a main component comprises a graphen.

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18. The electron-emitting device according to Claim 16, wherein each of the fibers comprising the carbon as a main component comprises a plurality of graphens.

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19. The electron-emitting device according to Claim 18, wherein said plurality of graphens are

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layered in an axis direction of the fiber comprising carbon as a main component.

20. The electron-emitting device according to  
5 Claim 16, wherein electrons are emitted by applying a voltage between said second electrode and said first electrode so that a potential of said second electrode is higher than that of the first electrode.

10 21. The electron-emitting device according to  
Claim 16, wherein a height from said substrate surface to said fibers is larger than a height from said substrate surface to a surface of the second electrode.

15 22. The electron-emitting device according to  
Claim 16, wherein a thickness of said first electrode is larger than a thickness of said second electrode.

23. The electron-emitting device according to  
20 Claim 16, wherein a first layer is placed between said first electrode and said fibers and said first layer comprises a Ti oxide, a Zr oxide, or an Nb oxide on a surface thereof.

25 24. The electron-emitting device according to  
Claim 23, wherein said fibers comprising carbon as a main component are fibers grown through a catalyst

material placed on said first layer.

25. The electron-emitting device according to  
Claim 24, wherein said catalyst material is either of  
5 Pd, Ni, Fe, Co, or an alloy thereof.

26. The electron-emitting device according to  
Claim 23, wherein said first layer is electrically  
conductive.

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27. The electron-emitting device according to  
Claim 23, wherein said first layer is covered by a  
second layer over the surfaces other than a surface  
facing said second electrode and said second layer  
15 consists of a material on which no substantial growth  
of fibers comprising carbon as a main component occurs  
as compared with said first layer.

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28. The electron-emitting device according to  
Claim 23, wherein said first layer is covered by a  
second layer over the surfaces other than a surface  
facing said second electrode and said second layer  
consists of a material selected from Ta, Cr, Au, Ag,  
Pt, and materials of the same kind as a catalyst  
25 material.

29. An electron source wherein a plurality of

electron-emitting devices as set forth in either one of  
Claims 16 to 28 are arrayed.

30. An image-forming apparatus comprising the  
5 electron source as set forth in Claim 29, and a  
fluorescent member.